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NASA TECHNICAL MEMORANDUM

TM-88508

p. 20

THE STRUCTURE OF THE ISHTAR TERRA CENTRAL AND EASTERN
PARTS AND SOME TECTONIC PROBLEMS OF VENUS

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Translation of "Stroyeniye tsentral'noy i vostochnoy chastey
zemli ishtar i nekotoryye problemy tektoniki venery",
Geotektonika, No. 4, July-August 1986, pp. 42-53.

(NASA-TM-88508) THE STRUCTURE OF THE ISHTAR
TERRA CENTRAL AND EASTERN PARTS AND SOME
TECTONIC PROBLEMS OF VENUS (National
Aeronautics and Space Administration) 20 p

N87-15145

CSCL 84B G3/91 43664

Unclas

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OCTOBER 1986

ORIGINAL PAGE IS
OF POOR QUALITY

STANDARD TITLE PAGE

1. Report No. NASA TM-88508	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle THE STRUCTURE OF THE ISHTAR TERRA CENTRAL AND EASTERN PARTS AND SOME TECTONIC PROBLEMS OF VENUS		5. Report Date October 1986	6. Performing Organization Code
		8. Performing Organization Report No.	10. Work Unit No.
7. Author(s) A.T. Bazilevskiy		11. Contract or Grant No. NASW-4005	
9. Performing Organization Name and Address Leo Kanner Associates, Redwood City, California 94063		12. Type of Report and Period Covered Translation	
12. Sponsoring Agency Name and Address National Aeronautics and Space Ad- ministration, Washington, D.C. 20546		14. Sponsoring Agency Code	
13. Supplementary Notes Translation of "Stroyeniye tsentral'noy i vostochnoy chastey zemli ishtar i nekotoryye problemy tektoniki venery", Geotektonika, No. 4, July-August 1986, pp. 42-53.			
16. Abstract As we move from Maxwell Montes to the eastern edge of Ishtar Terra there is a gradual shift in submeridional meandering folded ranges in the western section of the area to straight intersecting disjunctive systems of con- nected faults and sublatitudinal shifts. These disjunc- tive systems evidently transform older structures; the major axis of the stresses created by them is primarily oriented sublatitudinally. Relative to younger structures, in the western part they occupy a higher hypsometric posi- tion. The reason for the formation of this entire system may be a large asthenospheric flow which rises in the region of Lakshmi Planum and Maxwell Montes and which spreads and plunges in an easterly direction, taking with it deformed blocks of the lithosphere.			
17. Key Words (Selected by Author(s))		18. Distribution Statement Unclassified-Unlimited	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22.

THE STRUCTURE OF THE ISHTAR TERRA CENTRAL AND EASTERN
PARTS AND SOME TECTONIC PROBLEMS OF VENUS

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Photographs of Venus taken with the help of lateral surveillance /42* radar devices installed on the Venera-15 and -16 spacecraft made it possible to obtain images with resolution 1-2 km over approximately 1/4 of the area of its surface. The first results of the geological-morphological interpretation of these images are presented in [1-5]. A brief geological-morphological description of the entire area photographed and several preliminary conclusions on the tectonics of Venus are presented in [4] which opens this issue of the present journal. The purpose of our work is to describe in greater detail the central and eastern parts of Ishtar Terra from Maxwell Montes in the east to the eastern extreme of Ishtar Terra and on the basis of an analysis of the described characteristics to determine the nature of this formation.

Ishtar Terra is one of the two largest plateau regions on Venus. In area it is approximately equal to the Australian continent on earth and it rises above the surrounding plains which are at the mean planetary level by 2-10 km. The other large plateau area on Venus is Aphrodite Terra which in area is approximately equal to Africa and which rises above the adjacent plains to 2-5 km; it was not within the photographic zone of Venera-15 and -16.

The nature of the plains and plateau regions of Venus was first discussed seriously after radar photographs with resolution 20-40 km were taken of its surface by the Pioneer-Venera-Orbiter spacecraft. As a result, a global orographic zoning was done with isolation of plains and plateaus and some of their physical characteristics were

* Numbers in the margin indicate pagination in the foreign text.

determined [7]. With respect to plains at the mean planetary hypsometric level which have hilly mesorelief and which contain large ring-shaped structures, the conclusion was drawn that inside them continental material from Venus' ancient crust comes to the surface. With respect to plains at low hypsometric levels, the conclusion was drawn that they may be basaltic plains similar to the plains in the lunar seas. With respect to the largest plateaus in the Aphrodite and Ishtar regions, no conclusions were drawn about their nature. The analysis done of results of higher resolution radar photography which was conducted on the Venera-15 and -16 spacecraft showed that both depression plains and plains with hypsometric levels close to the mean planetary level are basically vulcanogenic lava (basalt) with the possible subordinate participation of anemoclastic accumulations. Ishtar Terra turned out to be a region of broad development of intensive tectonic disturbances of a surface character, in its eastern part (Lakshmi Planum) these are partially overlapped by coverings, probably of basaltic lava [2-4]. The character of tectonic deformations inside Ishtar Terra was practically not discussed in these works. Such a discussion is conducted in the present article and in several other articles in this issue (M.S. Markova, A.A. Pronin, L.B. Ronka). /43

Observations

Within Ishtar Terra, from Maxwell Montes and further to the east down to the eastern edge of Ishtar Terra, stretches a band of very rugged terrain with the predominance of subparallel and intersecting ranges and basins separating them (fig. 1). This band will be the subject of our description and analysis. Within Ishtar Terra there are other zones in which very rugged basin and range relief develops; these zones are described in other articles in this issue. The band of terrain with very rugged relief which is described in this article begins with Maxwell Montes which form a compact mountain massif approximately 600 km wide and 500 km long; this rises not only over plains with low and average hypsometric levels, but also over all of

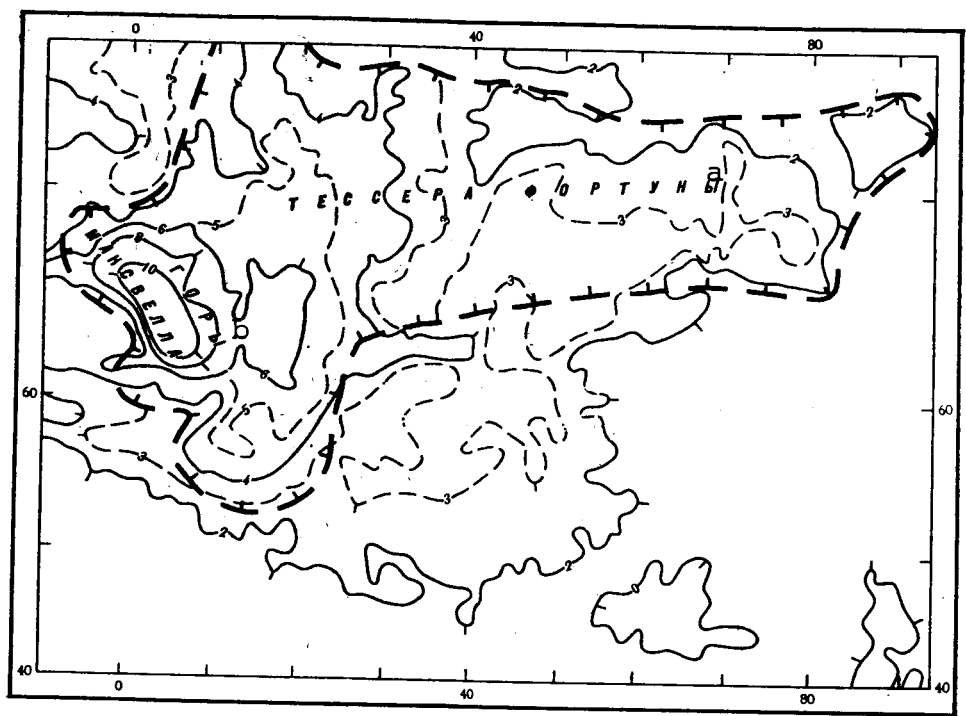


Fig. 1. A schematic hypsometric map of the region under investigation. The boundary of the described band of very rugged terrain is shown by the dotted line.

Key: a-Fortuna Tessera
b-Maxwell Montes

the other regions in Ishtar Terra. North of Maxwell Montes the described band of terrain with very rugged relief begins to broaden to almost 2000 km and then it narrows rapidly to 1000 km and then, as it continues to narrow gradually, it continues east to 90° east longitude. This area within the described band north of Maxwell Montes and to its eastern edge has received the geographic designation Fortuna Tessera.¹

As was already stated above, the western part of this band begins at Maxwell Montes. These are the highest mountains on Venus and at their vertices the radioaltimeters on the Pioneer-Venera and

¹ Tessera is a term used in planetary nomenclature to designate an area in which systems of intersecting basins and ranges predominate.

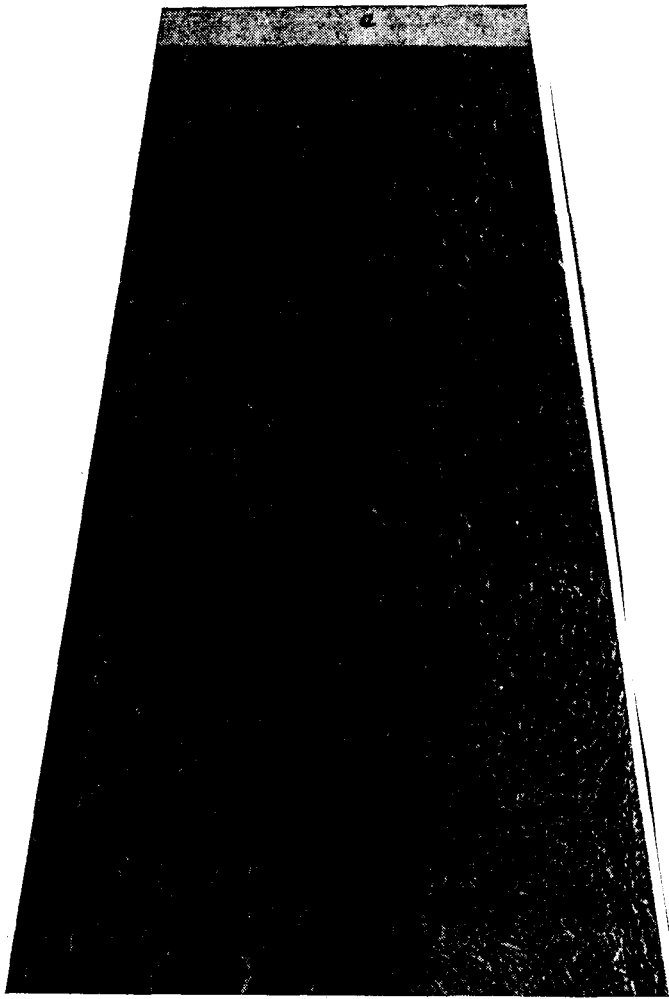
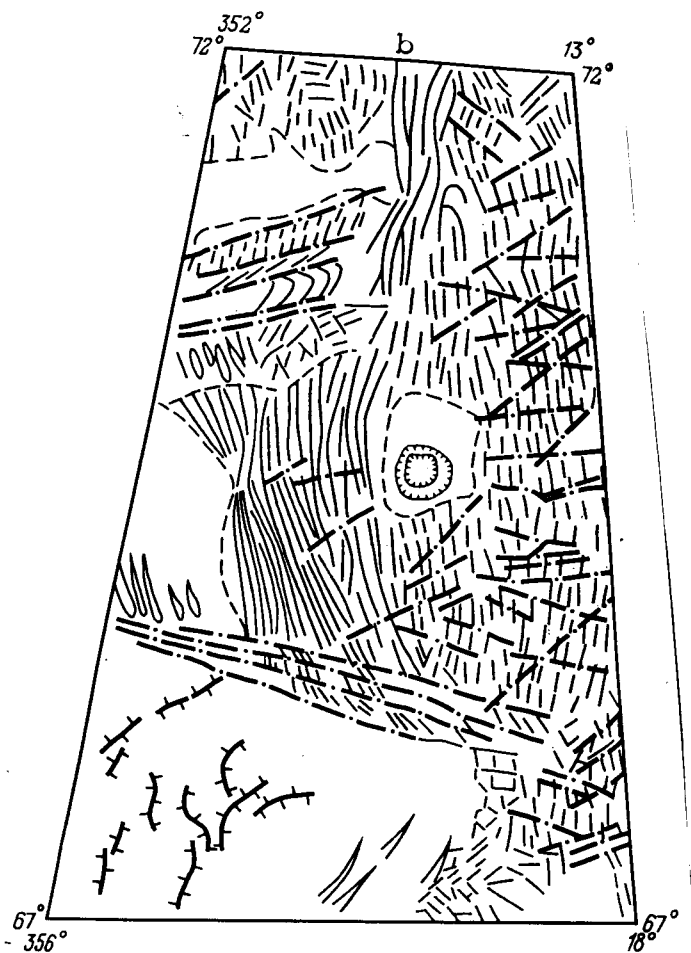


Fig. 2. Maxwell Montes and adjacent territories. North is up. a-a fragment of the photographic map made at IRE of the USSR Academy of Sciences on Maxwell Montes, b-the scheme for deciphering the lineaments. The section extends 1500 km from north to south

Venera-15 and -16 spacecraft recorded altitude readings of 6062-6062.5 km above the center of mass of Venus; this is 11.5 km higher than the level which corresponds to the average radius of Venus (6051 km). Inside Maxwell Montes the surface relief is determined by a system of subparallel ranges and basins which separate them (fig. 2); these are from 3-5 to 10-20 km wide (here and below measurement is done from the ridge of one range to the ridge of the neighboring range). Individual ranges and basins may be followed for tens or even several hundreds of kilometers and the entire system extends in a north-northwesterly direction for approximately 600 km. The course of the ranges and basins is also north-northwesterly, in accordance with the general course of their system and the massif of Maxwell Montes as a whole. On the west, Maxwell Montes are bounded by the plain surface of Lakshmi Planum which here is at

a level of 6055.5-6056.5 km above the center of mass of the planet. On the surface of the Planum we see arc-shaped gaping cracks with a northwesterly course, as if they push up against the southern boundary of the Planum here. The length of these cracks may attain 150-170 km and their width, 10-15 km. Apart from cracks on the



surface of the Planum we can see flow-like bands with increased surface radiobrightness; these are tens of kilometers long and up to 10-15 km wide. Further to the west on the surface of Lakshmi Planum similar flow-like bands diverge radially from the presumed volcanic Collette caldera and they are probably solidified flows of basaltic lava which differ from the surrounding area by their increased surface roughness [2-4].

At the boundary of Lakshmi Planum and the Maxwell massif on the surface of the Planum we see ranges which are parallel to this boundary and which, increasing in length and clarity toward the east as the terrain

risers, go into a system of subparallel ranges and separating basins which are characteristic of this mountain massif. Along the boundary with the Planum in a band 60-120 km wide which forms the western /44 slope of the Maxwell massif, the ranges and separating basins are narrower and have a characteristic width of 4-8 km. These ranges are usually more or less symmetrical. Asymmetric ranges with steeper slopes turned toward the west are characteristic of the northwestern part of the boundary of Maxwell Montes and the Planum. Asymmetric ranges with steeper slopes turned toward the east are encountered rarely within this band. With the general north-northwesterly course of the ranges and basins, their clearly expressed meandering is characteristic; this coincides with the meandering in the figure of

the isohypses which outline the western slope of the Maxwell massif. On the whole this structural figure recalls a figure of the conformable crushing of some more or less pliable material.

At the vertex of the massif of Maxwell Montes there is also a north-northwesterly oriented band 150-220 km wide where the picture of ranges and basins is rougher. The usual width of the ranges here is 12-20 km. Conformable curvature on the map is not so characteristic here as it is in the western band. The ranges themselves are often asymmetrical with steeper slopes turned toward the east; they are frequently broken up into segments a few tens of kilometers long which are separated by shift lines which run perpendicular to the ranges and which affect one or several neighboring ranges.

On the eastern slope of the Maxwell massif the characteristic width of the ranges in the general north-northwesterly system decreases to 4-10 km and the length over which individual ranges or basins may extend is small; usually from 10-15 to 30-40 km. At the ends of the individual ranges we can see clear shift lines which are transverse to the orientation of the ranges and which have west-northwesterly and northeasterly courses. This type of terrain is observed in the southern part of the eastern slope of Maxwell Montes and the northern part of this slope is occupied by the pronounced Cleopatra Patera (diameter 100 km) and the surrounding smooth relief zone where, from under the plain-forming material only rarely do we see individual short ranges with a north-northwesterly course. Cleopatra Patera has a narrow and poorly defined wall. Inside the 100-kilometer Cleopatra Patera there is another crater approximately 60 km in diameter, its center is shifted from the center of the exterior crater in the northwesterly direction. This interior crater has a wall which is clearly defined in the eastern and poorly defined in the western halves of the crater. The floor of the interior crater is approximately 1 km lower than the floor of the exterior crater and it in turn is lower than the wall which surrounds the crater by 1.5 km. In the orientation of the mountain ranges which

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are 150-300 km from Cleopatra Patera we see some concentricity with respect to this structure. But close to it no deviation from the general north-northwesterly course of the ranges is observed and we have the impression of a formation which is clearly superimposed on a previously existing system of subparallel ranges and basins. The double ring structure of Cleopatra Patera recalls the impact craters 100-150 km in diameter which were detected during the analysis of data from Venera-15 and -16, for example the 140-kilometer Clone crater north of Tethus Regio [1].

South of Maxwell Montes we find the "bay" of Sedna Planitia with a surface level 6053-6054 km above the center of mass. The surface of this plain section is complicated by meandering ranges and one of the systems of these ranges abuts the ranges in the western part of Maxwell Montes and it is like a degenerate continuation of the Montes in the plain. Along the boundary of this plain section and the eastern part of Lakshmi Planum along the southern extremes of the arc-shaped gaping cracks described above, we see poorly defined radio-albedo lines with a west-northwesterly course. These, continuing to the southern extreme of Maxwell Montes, are in the form of lines in which breaks in the continuity of the ranges or fold curves in the map arise. The boundary of the plain and the southern extreme of Maxwell Montes is very sharp over most of it - along the escarpment a tectonic impression is created. Only in its eastern part does plain-forming material begin to irrupt in a bay shape in the depressions between the individual ranges; this evidently indicates its youth relative to these sections of the basin and range terrain. From the east the plain section being described is bounded by the ranges and basins of the southwestern extreme of Fortuna Tessera (see below). Here plain-forming material also forms bays in the basin and range terrain and it is clearly younger than this terrain. Along the boundary and at some distance from it toward the west a system of subparallel and slightly curved gaping cracks up to several kilometers wide and up to 100 km long develops. On the surface of the plain we observe individual domes up to 10 km in diameter and

also groups of them. Craters are observed at the vertices of several of them at the limit of resolution.

North-northwest of Maxwell Montes we find a terrain with a complex combination of smoothed sections and sections with rugged relief. The hypsometric level of this terrain is 6053-6055 km above the center of mass. Further to the north, this terrain goes into a plain which occupies most of the north polar region above 75° n.l. At the boundary with Maxwell Montes the terrain with hypsometric level 6053-6055 km has the following structure. At the northern extreme of Maxwell Montes there is a section with a rolling-range surface which is atypical and smoother than at other sites in these mountains; however the surface altitudes in this section (6058-6060 km) show unambiguously that it is part of the massif of Maxwell Montes. This section has sufficiently sharp and linear boundaries with the systems of subparallel ranges and basins which, as they abut it, bend or form amorphous groups. The northern boundary of this section (it is the northern boundary of Maxwell Montes) is also very clear and it has the form of a band with east-northeasterly course to which systems of subparallel conformably curved ranges and basins on the order of 5 km wide approach at acute angles. At the junctions with this boundary these ranges and basins have an east-northeasterly course; with increasing distance from the boundary they gradually change their orientation to northerly and even to northwesterly and they are set in a system of extensive subparallel basins and ranges with an east-northeasterly course. Several gaping cracks with a westerly course pass through the northern extreme of Maxwell Montes and the adjacent area of ranges and basins with changing orientation; they are wider (up to 4-6 km) at their southeastern extremes and they become narrower toward the northeast. /46

North of Cleopatra Patera the band of terrain with very rugged basin and range relief broadens to approximately 2000 km and the surface altitudes decrease to 6054-6057 above the center of mass of the planet. This region is not part of Maxwell Montes, but is the western

part of Fortuna Tessera. Systems of subparallel ranges and basins with characteristic width of the ranges 5-20 km determine the character of the terrain, as in Maxwell Montes, but in comparison with Maxwell Montes the ranges and basins themselves undergo some changes. Their general orientation approaches meridional and in the structure of the ranges their separation into segments usually a few tens of kilometers long becomes more pronounced; the boundaries between the segments are transverse to the ranges of the lines of shift at the west-northwest and northeast compass points. These lines of shift clearly split the structural picture of subparallel ranges and basins which is more recent than they are. Between the lines of shift at the northwest and northeast compass points it was not possible to establish age relations, evidently because they were the same age (fig. 3). /47

Further to the east of the band, the very rugged terrain being described narrows to 1000 km and then to several hundred kilometers and the hypsometric level inside it is reduced to 6052-6053 km above the center of mass. Here the surface relief is defined by systems of intersecting ranges and basins which are as wide as those in Maxwell Montes (5-20 km) but the length of which, because of partial intersections which disturb continuity in one form or another, usually does not exceed a few tens of kilometers; only rarely may the individual ranges be followed for 100 km or the basins for 150 km. Two directions predominate in the system of intersecting ranges and basins - the northwest and northeast. The angles of intersection of the ranges and basins in these two characteristic directions are sometimes close to 90° (orthogonal structural picture), but more frequently they are considerably less than 90° and usually lie in the range $45-75^\circ$ (diagonal or chevron structural picture). In places the forms of the northwestern orientation split the forms of the northeastern orientation and in places they are split by the latter. On the whole both directions are equal mutually split directions. Sometimes the combinations of ranges and basins form ring or reticulate structures. The type of terrain described, in which systems of

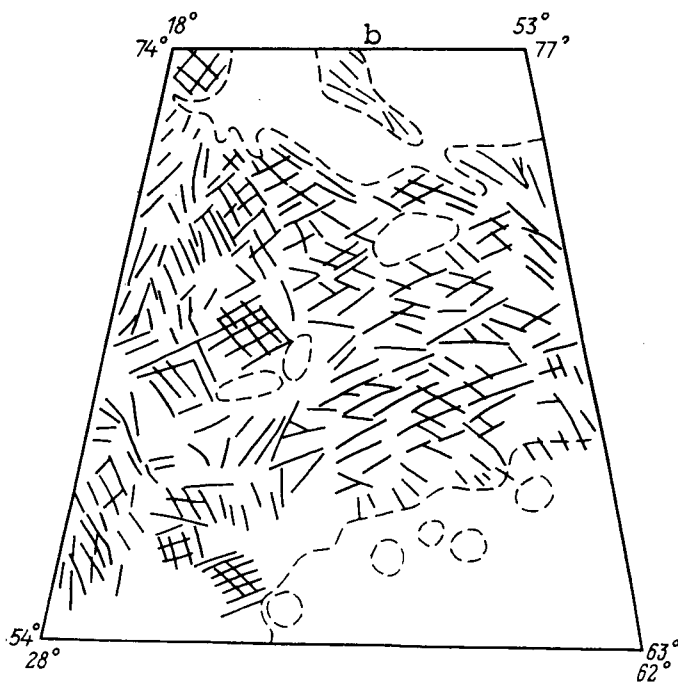
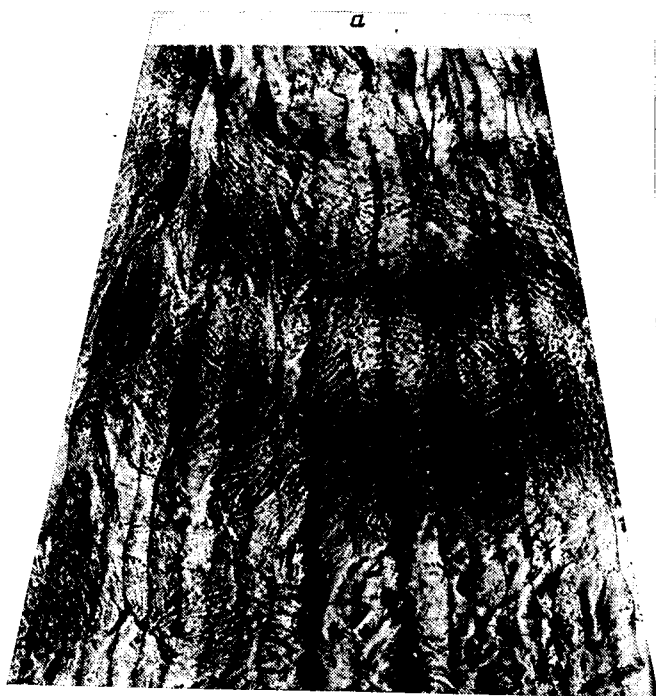


Fig. 3. The central part of Fortuna Tessera. North is up. a-fragment from a photomosaic made at GEOKhI of the USSR Academy of Sciences, b-scheme for deciphering

intersecting ranges and basins /48 develop, is given the brief conventional designation "parquet" because of the character of its structural picture [2, 3]. The transition from systems of subparallel ranges and basins which are separated by parallel lines of shift characteristic of the western part of Fortuna Tessera to diagonal and orthogonal systems of /50 intersecting ranges and basins in its central part is gradual.

Inside the region of orthogonally and diagonally intersecting ranges and basins, individual sections with lengthened form develop (up to 100-200 km in length). Here the surface is that of a plain and from beneath the plain-forming material individual ranges which continue from the surrounding intersected terrain pass. In these sections there are often domes 5-10 km in diameter; sometimes there are barely visible craters at their vertices.

This part of Fortuna Tessera is bounded on the north by a plain which is a part of the

the lineaments. The section extends broad north polar plain. At 1500 km from north to south the point of contact the plain-forming material enters the depression between the ranges; this indicates its relative youth as compared to the age of the terrain of intersecting ranges and basins.

On the south in the band of longitudes 30-40° e.l. a peculiar terrain, in which the spots and bands of the intersecting ranges and basins (as a rule, narrower than in the type of terrain described above) alternate with sections of the plain type, in which the surface is sometimes complicated only by rare ridges and domes and is sometimes "wrinkled" into a system of thin subparallel and intersecting ranges and basins, about the region in which intersecting ranges and basins develop. Between these wrinkled sections and the systems of intersecting ranges and basins in the central part of Fortuna Tessera there are gradual shifts in places. It is possible that this area which is adjacent on the south should not be separated from the "parquet" in the central part of Fortuna Tessera, but should be seen as a variation of it.

Further to the east the systems of intersecting ranges and basins of Fortuna Tessera are bounded on the south by a plain, the surface of which is complicated by poorly defined rounded structures from 20 to 70 km in diameter, ridges and small (5-10 km in diameter) domes. The transition from the region in which the ranges and basins develop to the plain is gradual, the width of the ranges and basins decreases and they gradually go into a system of cracks which separate this plain into a narrow boundary band. Evidently, here the plain is older than the parquet (fig. 4).

At the eastern extreme of Fortuna Tessera, which is simultaneously the eastern extreme of Ishtar Terra, on the whole the width of the band in which ranges and basins develop decreases to 600-400 km. Here, along with the above-described systems of diagonally intersecting ranges and basins, in places there are systems of extensive

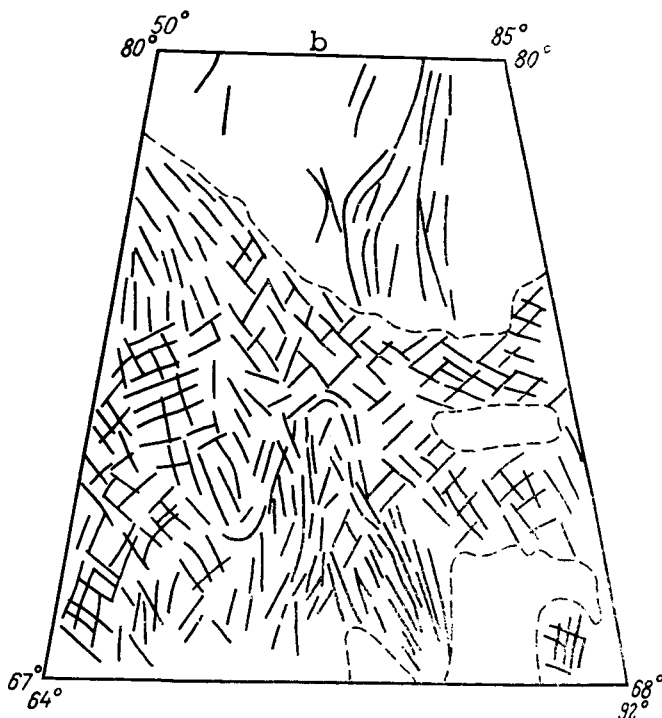


Fig. 4. The northeastern extreme of Fortuna Tessera. North is up.

subparallel meridionally oriented and frequently asymmetrical (the eastern edge is steeper than the western) ranges and basins which separate them; these are similar to the ranges and basins in the western part of Fortuna Tessera. Sections in which plain terrain develops separate zones in which ranges and basins develop at individual points. These intraparquet plain sections are similar to the bays in the more extensive plains which surround Fortuna Tessera. This ingression contact indicates the relative youth of the plain-forming material. But this is true only for some of the plain-forming material in this zone. In the plain which is adjacent to the north we see a band of ridges which extends in the meridional direction; this is evidently split by the parquet zone and is also evidently older than the latter. It is clear that here a significant part of the northern plain is older than the parquet, but along the points of contact younger plain-forming material develops; this forms the ingression relations observed.

a-fragment from the photomosaic made at GEOKhI of the USSR Academy of Sciences, b-scheme for deciphering the lineaments. The section extends 1300 km from north to south

Discussion

It follows from the description presented in the previous section that a band with very rugged relief extends from

Maxwell Montes to the northeastern extreme of Ishtar Terra. This is comprised of systems of subparallel and intersecting ranges and basins and it is elevated with respect to the plain terrain adjacent to it in almost all directions. This ruggedness of relief is evidently /51 a result of tectonic deformations, as indicated by the angular-fragmentary character of the outlines of many of the ranges and by numerous cases of shifts and intersections of some forms by others. The subparallel ranges in Maxwell Montes and in the western and eastern extremes of Fortuna Tessera are similar in external appearance to overturned linear folds or tectonic plates of the upthrust-overthrust type. We have no sufficient bases upon which to make a reasoned choice between folding or disjunctive mechanisms for the formation of these ranges. We note only that the meandering character of the orientation of the system of ranges in the western part of Maxwell Montes shown on the map is evidently characteristic of folding formation and the more linear or angular appearance of the ranges and segments of them in the other parts of Maxwell Montes and inside Fortuna Tessera is evidently more characteristic of disjunctive tectonic plates. In [1-4,7] proofs were adduced of the extremely low rates of exogenous erosion and deposition on Venus. This means that in the zone of the Venera-15 and -16 photographs we see the first practically undistorted exogenous processes in the relief of tectonic, volcanic or meteorite-impact origin. It follows from this that within the band described the relief of the ranges and basins is primary-tectonic and that the ranges and separating basins themselves were formed by deformations at the surface or almost at the surface; this distinguishes them, for example, from fold formations observed on the earth's surface; these were formed deep inside the earth and only later were brought to the surface by erosion. The surface character of the deformations must

evidently promote the development of disjunctive deformations more than folding ones.

The submeridional orientation of the systems of subparallel ranges and basins in Maxwell Montes and Fortuna Tessera evidently indicates that at the moment of their formation the major axis of stresses was oriented horizontally in the sublatitudinal direction. The systems of mutually intersecting ranges and basins with northwesterly and northeasterly courses which develop extensively in Fortuna Tessera and which intersect each other without any clear age preference of one direction over the other are surface combined fracture phenomena. An analysis of the orientation of the stress ellipses in this region shows that the major axis of stresses during the formation of these structures was also oriented horizontally, primarily in the sublatitudinal direction. The horizontal sublatitudinal orientation of the major axis of stresses evidently also arose during the formation of gaping wrinkle-cracks which are undoubtedly stretch cracks on the surface of Lakshmi Planum west of Maxwell Montes and at the northern extreme of Maxwell Montes. The sublatitudinal shift zones which extend from the southern extremes of these gaping crack-wrinkles to the boundary of Maxwell Montes with the plain section adjacent to the south and along the northern boundary of Maxwell Montes are evidently zones of shear deformations with primarily horizontal shifts in the sublatitudinal direction. Finally, inside the band of tectonic ranges and basins described the orientation of the major stresses differed in places from sublatitudinal, but even so the sharp predominance of sublatitudinal stresses directed along the long axis of the orientation band is evident here.

We will examine the position of this band of tectonic deformations on a broader regional map. Its western part, Maxwell Montes, comprises some of the components of the mountainous area around Lakshmi Planum. This surrounding area includes Akna Montes in the northwest, Freyja Montes in the north and northeast, Maxwell Montes in the east and the plateaus of Vesta Rupes in the south. In all of

these structures at the boundary with Lakshmi Planum, systems of ranges and basins subparallel to this boundary develop; with increasing distance from the Planum the character of the terrain gradually (Akna, Freyja and Maxwell Montes) or abruptly (Vesta Rupes) changes and the exterior parts of the mountainous frame of Lakshmi are represented by systems of intersecting ranges and basins of the parquet type. In all of these structures, the major axes of stress which arose during the formation of these relief-forming deformations are radial with respect to Lakshmi Planum. We recall that Lakshmi Planum is a zone in which large-scale volcanism, probably of the basaltic type, is manifested; this involves the development of the large Collette and Sacajawea calderas and radial systems of plain-forming lava flows around them. /52

The foregoing provides a basis for us to propose a hypothesis which explains the origin of the band of tectonic ranges and basins in Maxwell Montes and Fortuna Tessera as one of the components of the structure of Lakshmi Planum and its mountainous frame, i.e. the origin of almost the entire structure of one of the two largest plateau regions on Venus - Ishtar Terra. The motive force for the formation of this entire structure is a large anabatic flow in the mantle (asthenosphere) of Venus; this is probably the anabatic part of the large convective cell under Lakshmi Planum. The plutonic heat introduced by it is the reason for the large-scale basaltic volcanism of Lakshmi Planum and during uplift this anabatic flow itself "spreads" to the sides, causing horizontal stresses in the crust which are radial with respect to Lakshmi Planum. These stresses lead to the formation of folding deformations or systems of tectonic plates as the crustal material is heaped up; this leads to the formation of mountains. The spread of the hypothetical anabatic flow in the form of branches diverging in different directions occurs with various intensities and this leads to various degrees of definition of individual components of the mountainous frame formed. The maximum spread of the anabatic flow to the east led to the formation of the highest among the mountains around Lakshmi - Maxwell Montes

and the most extensive train of exterior deformations - Fortuna Tessera. Perhaps the Atalanta Planitia depression east of Ishtar Terra is a place in which this most powerful branch of the flow is submerged in the interior of the planet. When a horizontally spreading flow interacts with a more rigid crust (lithosphere), both compression and stretching may occur; this is determined by the fact that the motion of the flow under the deformed section is either decelerated or accelerated (this in turn is controlled by the hydrodynamics of the asthenospheric flows) or by the fact that the effectiveness of transmitting stresses (friction) from the flow to the lithosphere decreases or increases.

Within the context of the proposed hypothesis, Maxwell Montes (and the other mountains at Lakshmi's boundaries) comprise the most active part of the deformation band (folds or tectonic plates) being formed above the spreading branch of the flow. Here the accumulation of crustal material occurs and the highest mountains form by the accumulation of crustal material which is lighter than the material of the underlying mantle and also perhaps by the dynamic maintenance of this accumulation by the moving flow. This deformation band grows from the edges to the center in the same way as ice gorges grow in an ice flow on a river near obstacles - in the direction opposite to the direction of the flow. This feature of the formation of mountains in the mountainous area around Lakshmi makes it possible for us to term this process "spot orogenesis". During the "accretion" of the next deformation section from the interior (turned toward the center of the anabatic flow) side of the component of the surrounding area which is being formed, previously formed sections undergo less dynamic processes or they stop completely and the altitude of this side decreases, although it does attain the level typical of undeformed regions (plains). Here, stresses transmitted to the lithosphere by a flow moving from below lead to the formation of systems of intersecting ranges and basins - parquet - as a result of the conversion of previously formed systems of subparallel ranges and basins and in places because of the deformation of previously undeformed sections.

We consider that the character of the tectonic development of a planet depends on the mechanism which predominates in carrying heat from the interior to the surface in the given planet (see, for example, [8]). We will examine three extreme conditions: 1) the convective transport of heat through the lithosphere; 2) the transport of heat primarily in spreading zones; 3) the transport of heat through "hot spots". The first case is typical of the modern moon and the second and to some degree the third are typical of the modern earth. From the results of our analysis and data presented in [2-4], in our opinion it follows that the mechanism of heat transport by "hot spots" is most characteristic of Venus. These hot spots vary in size from very large ones such as the heat source under Lakshmi Planum, to intermediate ones of the ovoid type, to small, morphologically expressed ones in the form of the numerous domes which dot the plains of Venus.

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